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EXAMINER

MOORE, PATRICK M

ART UNIT PAPER NUMBER

2188

DATE MAILED: 03/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                                      |  |  |
|------------------------------|--------------------------------------|--|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/753,608 | <b>Applicant(s)</b><br>FAIR, ROBERT L. |  |
|                              | <b>Examiner</b><br>Patrick M. Moore  | <b>Art Unit</b><br>2188                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 08 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-29 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>11/30/04 &amp; 9/8/05</u> . | 6) <input type="checkbox"/> Other: _____  |

### DETAILED ACTION

1. Claims 1-29 have been examined.

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

- MP*
2. Claims <sup>1-14 and</sup> ~~16~~ 1-29 are rejected under 35 U.S.C. 102(b) as being anticipates by Permut et al. (US Patent # 6,260,115), herein Permut.

a. As per Claim 1, Permut discloses a method for a storage operating system implemented in a storage system to optimize the amount of readahead data retrieved for a read stream established in a data container stored in the storage system, the method comprising: receiving a client read request at the storage system, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream **[Figure 7A, #700]**; determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request **[Figure 7A, #702]**; if it is determined that the storage operating system is permitted to retrieve readahead data from the data container **["Yes" branch of Figure 7A, #702 & #704]**, performing the steps of: (i) selecting an amount of readahead data to retrieve from the data container based on one or more factors **["Yes" branch of Figure 7A, #704 & Figure 7B, #720]**; and (ii)

retrieving the selected amount of readahead data from the data container

**[Figure 7B, #729, Column 3, Lines 31-49, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59].**

b. As per Claim 2, Permut further discloses the method of claim 1, wherein the data container is a file, directory, vdisk or lun **[Column 1, Lines 12-33 & Column 2, Lines 29-48].**

c. As per Claim 3, Permut further discloses the method of claim 1, wherein the storage operating system is determined to be permitted to retrieve readahead data from the data container when the client-requested data extends the read stream past a predetermined next readahead value **[Figure 7B, #722, #732, #734 & Column 11, Lines 38-48].**

d. As per Claim 4, Permut further discloses the method of claim 3, wherein the predetermined next readahead value is stored in a readset data structure associated with the read stream **[Figure 2, #200, #204, #210 & Column 11, Lines 38-48].**

e. As per Claim 5, Permut further discloses the method of claim 3, wherein the predetermined next readahead value is updated based on a percentage of the selected amount of readahead data **[Figure 7B, #740, #742, #744 & Column 11, Line 60 – Column 12, Line 12].**

f. As per Claim 6, Permut further discloses the method of claim 1, wherein a read-access style associated with the data container is one of the one or more

factors used to select the amount of readahead data **[Figure 2, #206 & Column 4, Lines 30-39]**.

g. As per Claim 7, Permut further discloses the method of claim 6, wherein the selected amount of readahead data equals zero if the read-access style corresponds to a random read-access style **[Column 2, Lines 51-66, Column 4, Lines 40-52 & Column 6, Lines 16-47]**.

h. As per Claim 8, Permut further discloses the method of claim 1, wherein a number of client read requests processed in the read stream is one of the one or more factors used to select the amount of readahead data **[Column 4, Lines 53-67]**.

i. As per Claim 9, Permut further discloses the method of claim 8, wherein the number of client read requests processed in the read stream is stored as a count value in a readset data structure associated with the read stream **[Figure 2, #208]**.

j. As per Claim 10, Permut further discloses the method of claim 1, wherein the amount of client-requested data is one of the one or more factors used to select the amount of readahead data **[Column 5, Lines 1-6]**.

k. As per Claim 11, Permut further discloses the method of claim 10, wherein the selected amount of readahead data is set equal to a predetermined upper limit for large amounts of client-requested data **[Column 4, Lines 7-21]**.

l. As per Claim 12, Permut further discloses the method of claim 1, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value **[Column 10, Lines 47-59]**.

m. As per Claim 13, Permut further discloses the method of claim 1, wherein the client-requested data is identified as read-once data when either (i) the number of client read requests processed in the read stream is greater than a second threshold value **[Figure 2, #208 & Column 4, Lines 6-21]** or (ii) a set of metadata associated with the read stream indicates that the client-requested data is read-once data **[Figure 2, #206 & Column 11, Lines 38-48]**. Examiner understands an entry's position on a candidate list, as disclosed by Permut, to be functionally equivalent to "metadata" claimed by applicant because they both identify read-once data requested from a client.

n. As per Claim 14, Permut further discloses the method of claim 1, wherein the selected amount of readahead data is stored in one or more buffers enqueued on a flush queue, the flush queue being configured to reuse buffers after a predetermined period of time **[Column 3, Lines 11-30 & Column 5, Lines 15-18]**.

o. As per Claim 16, Permut discloses an apparatus configured to implement a storage operating system that optimizes the amount of readahead data retrieved for a read stream established in a data container stored in the apparatus, the

apparatus comprising: means for receiving a client read request, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream **[Column 3, Lines 31-49]**; means for determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request **[Figure 7A, #702]**; means for selecting an amount of readahead data to retrieve from the data container based on one or more factors **[“Yes” branch of Figure 7A, #704 & Figure 7B, #720]**; and means for retrieving the selected amount of readahead data from the data container **[Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59]**.

p. As per Claim 17, Permut further discloses the apparatus of claim 16, wherein the data container is a file, directory, vdisk or lun **[Column 1, Lines 12-33 & Column 2, Lines 29-48]**.

q. As per Claim 18, Permut further discloses the apparatus of claim 16, wherein the storage operating system is determined to be permitted to retrieve readahead data from the data container when the client-requested data extends the read stream past a predetermined next readahead value **[Figure 7B, #722, #732, #734 & Column 11, Lines 38-48]**.

r. As per Claim 19, Permut further discloses the apparatus of claim 18, further comprising means for updating the predetermined next readahead value based

on a percentage of the selected amount of readahead data **[Figure 7B, #740, #742, #744 & Column 11, Line 60 – Column 12, Line 12]**.

s. As per Claim 20, Permut further discloses the apparatus of claim 16, wherein the one or more factors used to select the amount of readahead data includes at least one of: (i) the amount of client-requested data **[Column 5, Lines 1-6]**, (ii) a number of client read requests processed in the read stream **[Column 4, Lines 53-67]**, and (iii) a read-access style associated with the data container **[Figure 2, #206 & Column 4, Lines 30-39]**.

t. As per Claim 21, Permut further discloses the apparatus of claim 16, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value **[Column 10, Lines 47-59]**.

u. As per Claim 22, Permut discloses a storage system configured to optimize the amount of readahead data retrieved for a read stream established in a data container stored in the storage system, the storage system comprising: a network adapter for receiving a client read request, the client read request indicating client-requested data to retrieve from the data container containing the read stream **[Column 3, Lines 31-49]**; and a memory configured to store instructions for implementing a storage operating system **[Column 1, Lines 19-22]** that performs the steps of: determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the



received client read request **[Figure 7A, #702]**, and if it is determined that the storage operating system is permitted to retrieve readahead data from the data container **["Yes" branch of Figure 7A, #702 & #704]**: (i) selecting an amount of readahead data to retrieve from the data container based on one or more factors **["Yes" branch of Figure 7A, #704 & Figure 7B, #720]**; and (ii) retrieving the selected amount of readahead data from the data container **[Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59]**. Examiner understands that it is well known in the art that a network adapter is an inherent component of the system taught by Permut.

v. As per Claim 23, Permut further discloses the storage system of claim 22, wherein the data container is a file, directory, vdisk or lun **[Column 1, Lines 12-33 & Column 2, Lines 29-48]**.

w. As per Claim 24, Permut further discloses the storage system of claim 22, wherein the storage operating system is determined to be permitted to retrieve readahead data from the data container when the client-requested data extends the read stream past a predetermined next readahead value **[Figure 7B, #722, #732, #734 & Column 11, Lines 38-48]**.

x. As per Claim 25, Permut further discloses the storage system of claim 24, wherein the predetermined next readahead value is updated based on a percentage of the selected amount of readahead data **[Figure 7B, #740, #742, #744 & Column 11, Line 60 – Column 12, Line 12]**.

y. As per Claim 26, Permut further discloses the storage system of claim 22, wherein the one or more factors used to select the amount of readahead data includes at least one of: (i) the amount of client-requested data **[Column 5, Lines 1-6]**, (ii) a number of client read requests processed in the read stream **[Column 4, Lines 53-67]**, and (iii) a read-access style associated with the data container **[Figure 2, #206 & Column 4, Lines 30-39]**.

z. As per Claim 27, Permut further discloses the storage system of claim 22, wherein the selected amount of readahead data is doubled if the number of client read requests processed in the read stream is greater than a first threshold value **[Column 10, Lines 47-59]**.

aa. As per Claim 28, Permut discloses a computer-readable media comprising instructions for execution in a processor for the practice of a method for a storage operating system implemented in a storage system to optimize the amount of readahead data retrieved for a read stream established in a data container stored in the storage system, the method comprising: receiving a client read request at the storage system, the client read request indicating client-requested data for the storage operating system to retrieve from the data container containing the read stream **[Column 3, Lines 31-49]**; determining whether the storage operating system is permitted to retrieve readahead data from the data container in response to the received client read request **[Figure 7A, #702]**; if it is determined that the storage operating system is permitted to retrieve readahead data from the data container **[“Yes” branch of Figure 7A, #702 & #704]**,

performing the steps of: (i) selecting an amount of readahead data to retrieve from the data container based on one or more factors [**“Yes” branch of Figure 7A, #704 & Figure 7B, #720**]; and (ii) retrieving the selected amount of readahead data from the data container [**Figure 7B, #729, Column 8, Line 46 – Column 9, Line 8 & Column 10, Lines 32-59**].

bb. As per Claim 29, Permut further discloses the computer-readable media of claim 28, wherein the data container is a file, directory, vdisk or lun [**Column 1, Lines 12-33 & Column 2, Lines 29-48**].

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Permut et al. (US Patent # 6,260,115) as applied to Claims 1 & 14 above, and further in view of Vishlitzky et al. (US Patent # 5,649,156), herein Vishlitzky.

a. As per Claim 15, Permut does not expressly disclose a 2 second queue refresh period. However, Vishlitzky discloses the method of claim 14, wherein the predetermined period of time equals two seconds [**Column 7, Lines 41-52**]. Furthermore, Permut and Vishlitzky are analogous art because they are from the

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same problem solving area: Prefetch cache optimization in multi-stream data storage systems.

b. At the time of invention, it would have been obvious to a person of ordinary skill in the art to modify the sequential prestaging queue flush, as taught by Permut, to refresh with a period of 2 seconds, as taught by Vishlitzky to be well known in the art. The suggestion/motivation for doing so would have been for the benefit of balancing a minimum amount of open storage and a maximize amount of data stored in the queue, as taught by Permut in **Column 2, Line 51 - Column 3, Line 10**, and because after 2 seconds of inactivity, the chances are small that data will not be accessed again within a reasonable period of time, as taught by Vishlitzky.

### ***Conclusion***

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Goodwin et al. (US Patent # 5,371,870) teaches FIFO banked buffers that prefetch steam data. Greiner et al. (US Patent # 6,216,208) teaches a prefetch controller that responds to control signals from a cache reading sequential memory locations. Hill et al. (US Patent # 6,484,239) teaches a cache queue that forwards read requests to a prefetch queue, which is populated with sequential read requests. Bogin et al. (US Patent # 6,523,093) teaches a prefetch buffer populated by a read request controller. Hsu et al. (US Patent # 6,567,894) teaches a multi-streamed prefetch list employing a hit count to increase the percentage of prefetched data.

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5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patrick M. Moore whose telephone number is (571) 272-1239. The examiner can normally be reached on M-F 8:30AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabahn can be reached on (571) 272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PMM



**MANO PADMANABHAN  
SUPERVISORY PATENT EXAMINER**